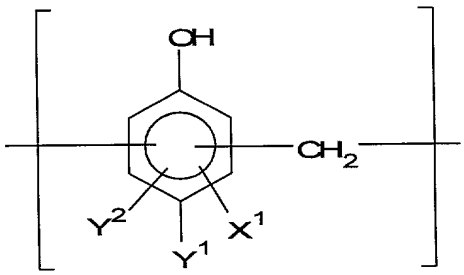
Claims

1. A coated metal article having on its surface a coating suitable for film lamination thereon, wherein:

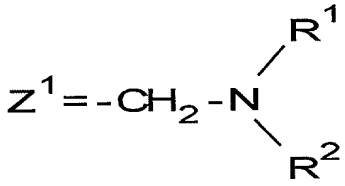
- said coating has a thickness that is from 5 to 500 nm;
- said coating has a content of carbon atoms that corresponds to from 5 to 500 mg/m^2 of the coating area;
- said coating covers at least 90 % of the surface of the metal; and
- said coating comprises polymer molecules that comprise units conforming to general formula (I):



(I)

in which:

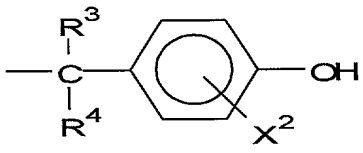
X^1 independently in each structural unit is a hydrogen atom or a moiety Z^1 conforming to general formula (II):



(II)

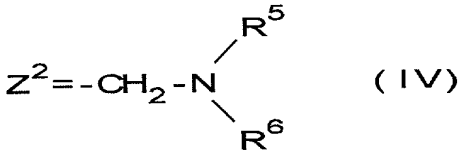
in which each of R^1 and R^2 independently is a hydrogen atom, a C_1 to C_{10} monovalent alkyl moiety, or a C_1 to C_{10} monovalent hydroxyalkyl moiety;

Y^1, independently for each unit, is a hydrogen atom, a hydroxyl group, a C_1 to C_5 alkyl moiety, a C_1 to C_5 hydroxyalkyl moiety, a C_6 to C_{12} aryl, benzyl, or benzo moiety, or a moiety conforming to general formula (III):



(III)

in which, independently for each unit according to general formula (I) in which Y^1 conforms to general formula (III), each of R^3 and R^4 is independently a hydrogen atom, a C_1 to C_{10} alkyl moiety, or a C_1 to C_{10} hydroxyalkyl moiety, and X^2 is a hydrogen atom or a moiety Z^2 conforming to general formula (IV):



(IV)

in which each of R^5 and R^6 is independently a hydrogen atom, a C_1 to C_{10} alkyl moiety, or a C_1 to C_{10} hydroxyalkyl moiety;

and

Y^2, independently for each unit, is a hydrogen atom or, when Y^1 and Y^2 are bonded to adjacent carbon atoms in the aromatic ring shown in general formula (I), Y^1, Y^2, and said adjacent carbon atoms to which Y^1 and Y^2 are bonded together may constitute a condensed benzene ring,

said polymer molecules that comprise structural units conforming to general formula (I) having a total number of Z^1 and Z^2 moieties and a distinct (but not necessarily unequal) total number of (i) units conforming to general formula (I) and (ii) Y^1 moieties that conform to general formula (III), such that the total number of Z^1 and Z^2 moieties has a ratio to the total number of units conforming to general formula (I) and Y^1 moieties that conform to general formula (III) that is from 0.2:1.0 to 1.0:1.0.

2. A coated metal article according to claim 1, in which Y^1 in general formula (I) conforms to general formula (III).

3. A coated metal article according to claim 2, in which the coating comprises a total of at least 0.1 mg/m^2 of phosphorus atoms present in phosphoric acid like compounds and silicon atoms present in organosilicon compounds.

4. A coated metal article according to claim 1, in which the coating comprises a total of at least 0.1 mg/m^2 of phosphorus atoms present in phosphoric acid like compounds and silicon atoms present in organosilicon compounds.

5. A coated metal article according to any one of claims 1 through 4, wherein:

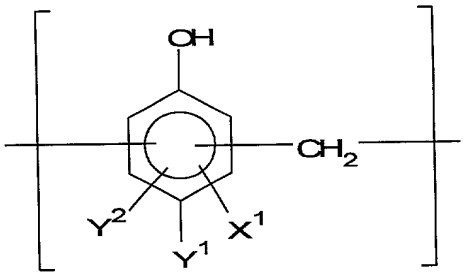
- said coating has a thickness in a range from 50 to 300 nm; and

- said coating has a content of carbon atoms that corresponds to from 50 to 200 mg/m^2 of the coating area.

6. A process for providing a surface of a metal substrate with a coating suitable for laminating film thereto, said process comprising steps of:

(I) providing a waterborne composition that comprises water and:

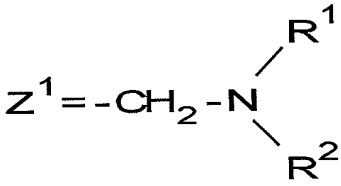
(A) at least 0.01 g/L of polymer molecules comprising units conforming to general formula (I):



(I)

in which:

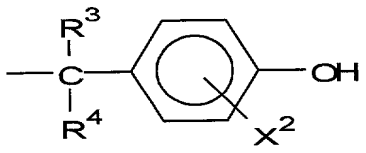
X^1, independently in each structural unit, is a hydrogen atom or a moiety Z^1 conforming to general formula (II):



(II)

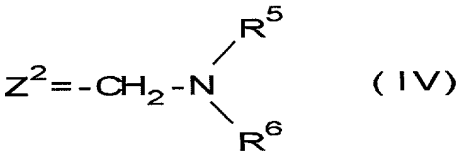
in which each of R^1 and R^2 independently is a hydrogen atom, a C_1 to C_{10} monovalent alkyl moiety, or a C_1 to C_{10} monovalent hydroxyalkyl moiety;

Y^1, independently in each structural unit, is a hydrogen atom, a hydroxyl group, a C_1 to C_5 alkyl moiety, a C_1 to C_5 hydroxyalkyl moiety, a C_6 to C_{12} aryl, benzyl, or benzo moiety, or a moiety conforming to general formula (III):



(III)

in which, independently for each unit according to general formula (I) in which Y^1 conforms to general formula (III), each of R^3 and R^4 is independently a hydrogen atom, a C_1 to C_{10} alkyl moiety, or a C_1 to C_{10} hydroxyalkyl moiety, and X^2 is a hydrogen atom or a moiety Z^2 conforming to general formula (IV):



(IV)

in which each of R^5 and R^6 is independently a hydrogen atom, a C_1 to C_{10} alkyl moiety, or a C_1 to C_{10} hydroxyalkyl moiety;

and

Y^2, independently in each structural unit, is a hydrogen atom or, when Y^1 and Y^2 are bonded to adjacent carbon atoms in the aromatic ring shown in general formula (I), Y^1, Y^2, and said adjacent carbon atoms to which Y^1 and Y^2 are bonded together may constitute a condensed benzene ring,

said polymer molecules that comprise structural units conforming to general formula (I) having a total number of Z^1 and Z^2 moieties and a distinct (but not necessarily unequal) total number of (i) units conforming to general formula (I) and (ii) Y^1 moieties that conform to general formula (III), such that the total number of Z^1 and Z^2 moieties has a ratio to the total number of units conforming to general formula (I) and Y^1 moieties that conform to general formula (III) that is from 0.2:1.0 to 1.0:1.0;

and, optionally, at least one of the following components:

(B) phosphoric acid-type compounds; and

(C) organosilicon compounds,

said waterborne composition having a pH in a range from 2.5 to 6.5;

(II) contacting said surface of said metal substrate with the waterborne composition provided in step (I) for a sufficient time at a sufficient temperature to form a solid coating containing constituents of said waterborne composition, said solid coating adhering to said surface of said metal substrate and being itself covered, at least initially; by a coating of liquid; and

(III) after step (II), drying the metal surface so as to remove from the metal surface the liquid constituents of the coating initially formed in step (II) or of a successor liquid coating formed by rinsing the surface of said metal substrate as modified after step (II) with water.

7. A process according to claim 6, in which Y^1 in general formula (I) conforms to general formula (III).

8. A process according to claim 7, in which the waterborne composition provided in step (I) comprises a total of at least 0.01 g/l of phosphorus atoms present in phosphoric acid like compounds and silicon atoms present in organosilicon compounds.

9. A process according to claim 6, in which the waterborne composition provided in step (I) comprises a total of at least 0.01 g/l of phosphorus atoms present in phosphoric acid like compounds and silicon atoms present in organosilicon compounds.

10. A process according to claim 7, wherein the waterborne composition provided in step (I) contains at least 0.1 g/L of polymer molecules comprising units conforming to general formula (I) and the coating of liquid formed in step (II) is rinsed with water so as to form a successor coating before completion of step (III).

11. A process according to claim 10, in which the waterborne composition provided in step (I) comprises a total of at least 0.1 g/l of phosphorus atoms present in phosphoric acid like compounds and silicon atoms present in organosilicon compounds.

12. A process according to claim 6, wherein the waterborne composition provided in step (I) contains at least 0.1 g/L of polymer molecules comprising units conforming to general formula (I) and the coating of liquid formed in step (II) is rinsed with water so as to form a successor coating before completion of step (III).

13. A process according to claim 12, in which the waterborne composition provided in step (I) comprises a total of at least 0.1 g/l of phosphorus atoms present in phosphoric acid like compounds and silicon atoms present in organosilicon compounds.